

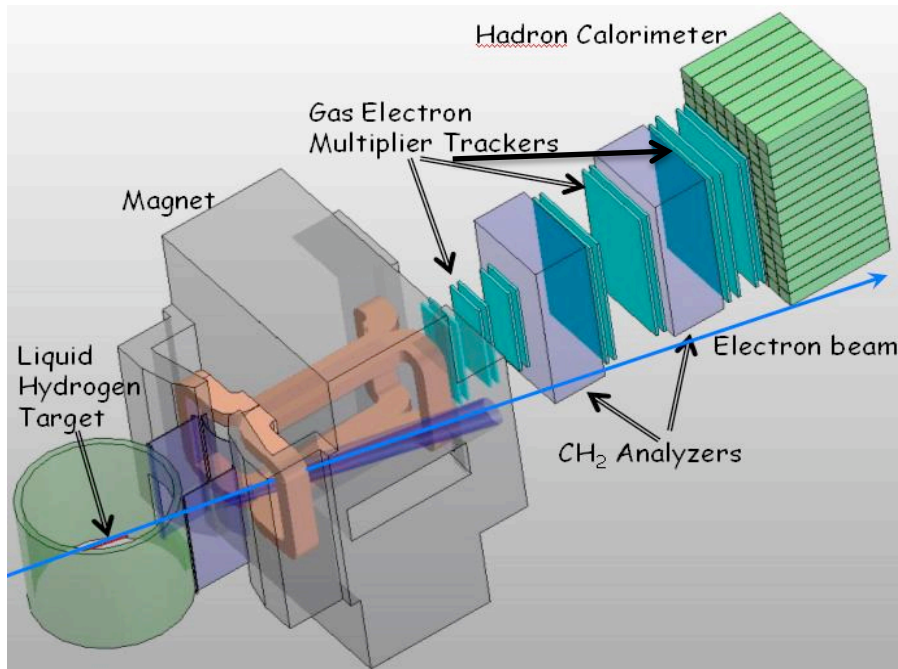


GEM Detector R&D at UVa

Nilanga Liyanage, University of Virginia

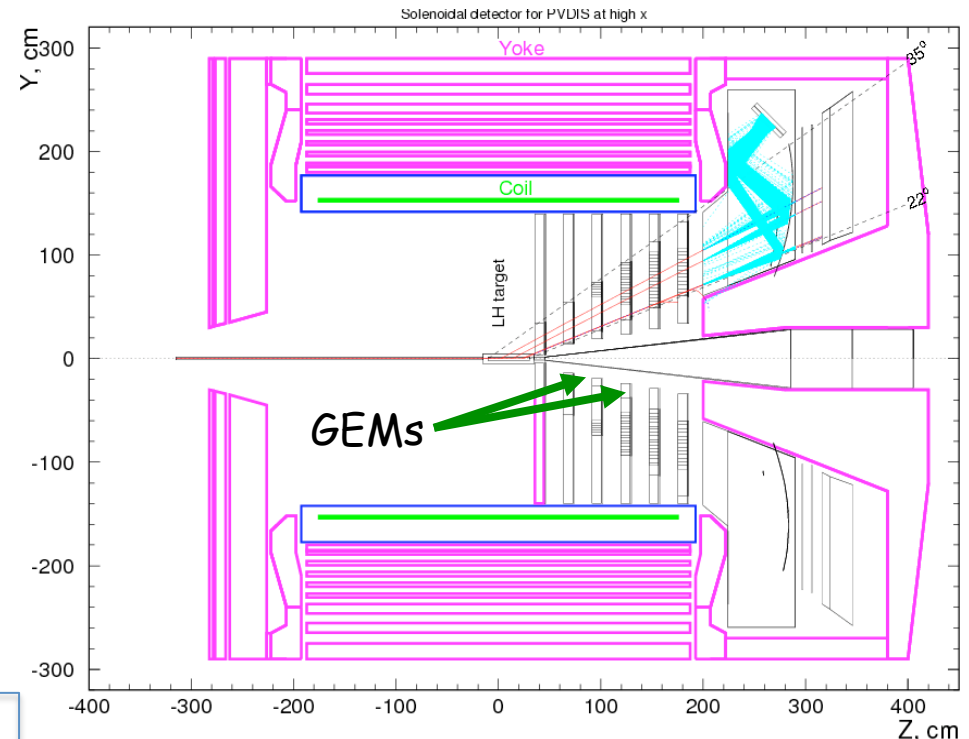
- The UVa group is a part of the RD51 Collaboration
- Currently conducting large area GEM detector R&D for two proposed spectrometers at Jefferson lab

Super-Bigbite Spectrometer



- Construct 3 large GEM trackers in collaboration with INFN-Rome
- 50 cm x 40 cm GEM modules will be used to assemble chambers up to 200 cm x 40 cm

SoLID spectrometer



- Circular GEM disks up to 1 m inner radius and 2.25 m outer radius.
- Total GEM chamber area coverage $\sim 33 \text{ m}^2$

GEM Trackers for SuperBigbite with FPP

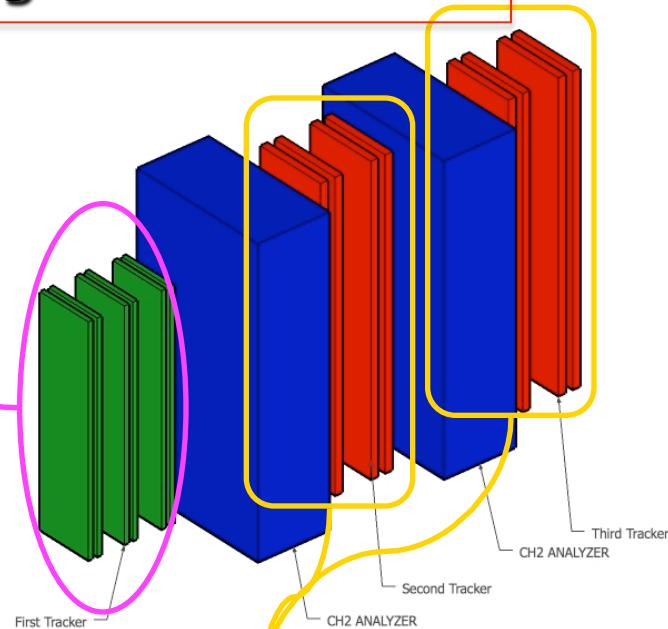
Front Tracker

- Six layers of GEM chambers each with an active area of 40 cm x 150 cm.
- Will be constructed in Rome
- Prototype modules already built and tested.



Courtesy of Evaristo Cisbani, INFN

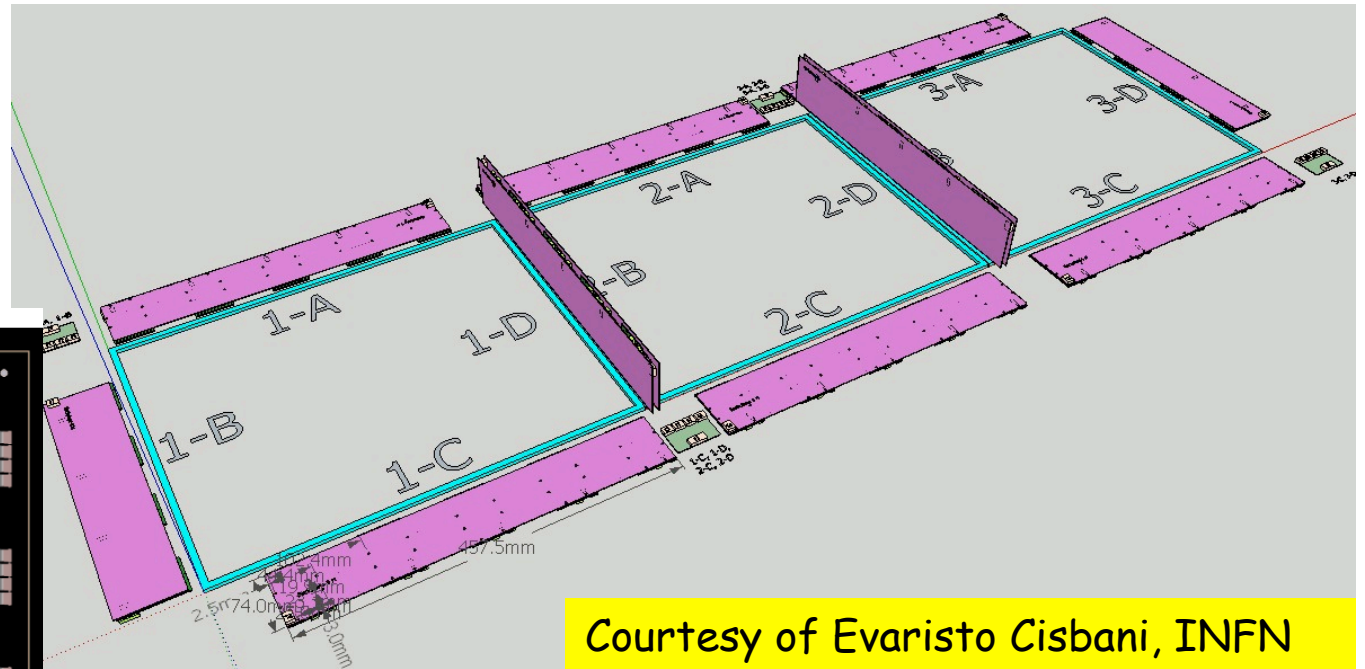
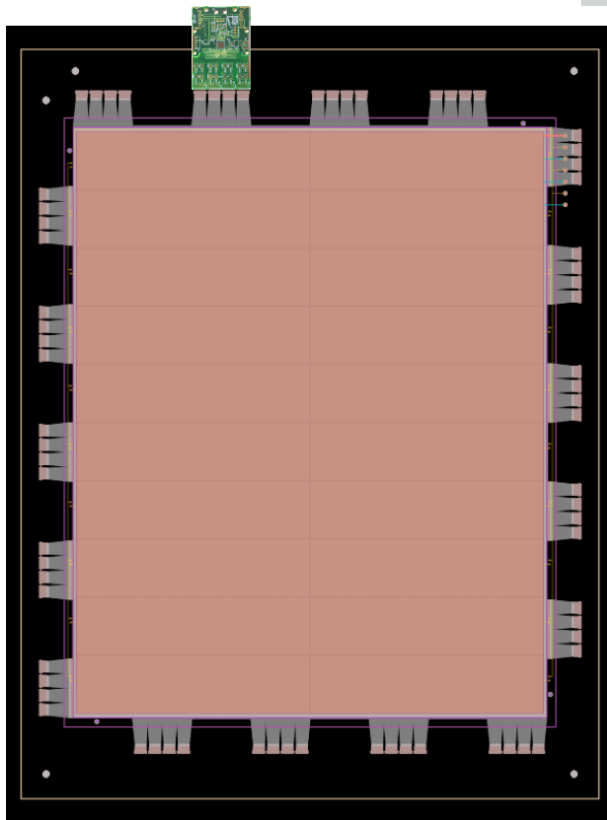
- > 100 k readout channels for all 3 trackers
- APV25 based electronics
- Expected project completion: 2015.



Back Trackers

- Eight layers of GEM chambers, each with an active area of 50 cm x 200 cm.
- Need to cover large areas, but only moderate position resolution needs: combine readout strips to form 1.6 mm wide readout channels.
- Studies of signal quality as a function of increased capacitance underway.
- Will be constructed at UVA
- Prototype modules will be built this summer.

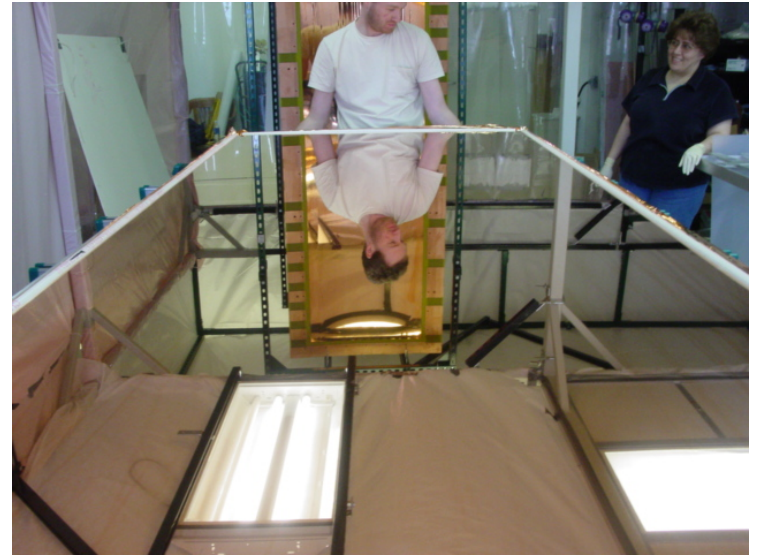
Key to Segmentation: keeping dead areas as narrow as possible



- 50 cm x 40 cm Modules are combined to form larger chambers with different sizes
- Electronics along the borders and behind the frame (at 90°).
- Flexible readout boards with bendable tabs to connect with the front-end boards.

UVa Detector Lab

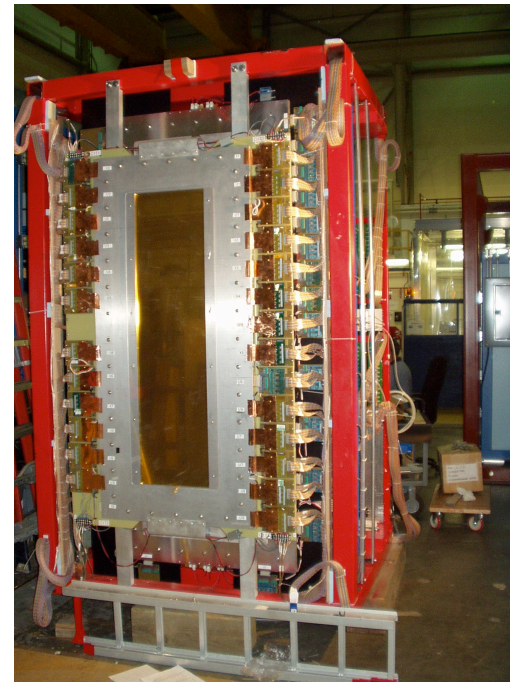
- A well equipped detector construction lab with a 4 m x 4 m clean-room - another clean room will be added later this year.
- Previously constructed a the Drift chamber based tracker for Bigbite spectrometer: 2 m x 0.5 m MWDCs.
- Prototype GEM tracker with five 10 cm x 10 cm chambers was also built here



Stretching 2 m x 0.5 m cathode planes .



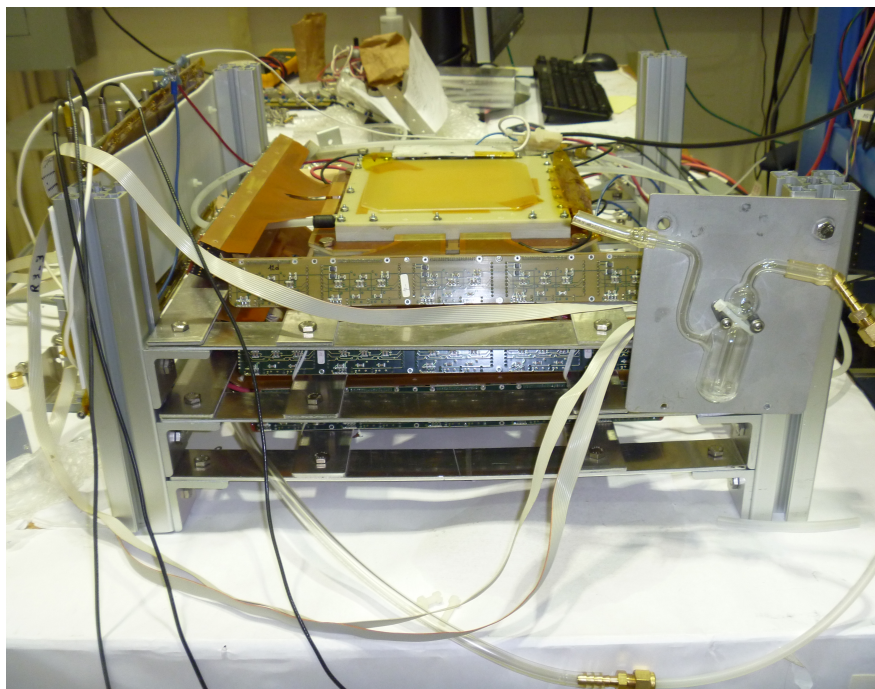
The UVa clean room.



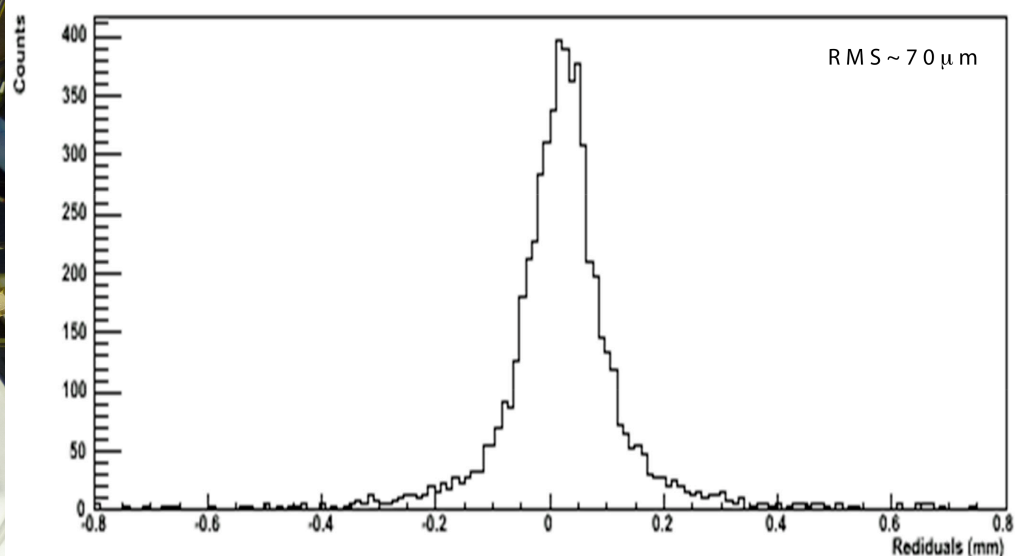
Bigbite MWDC tracker built at UVa.

Uva Prototype GEM tracker

- Prototype GEM tracker with five 10 cm x 10 cm constructed and beam tested in Jefferson Lab hall A last year.
- Currently being prepared for another test run later this year.
- Will be tested with new APV25 based electronics
- Plan to construct and test a 40 cm x 50 cm prototype this summer.



The prototype tracker being prepared for the beam test.



Track position resolution achieved during the beam test run

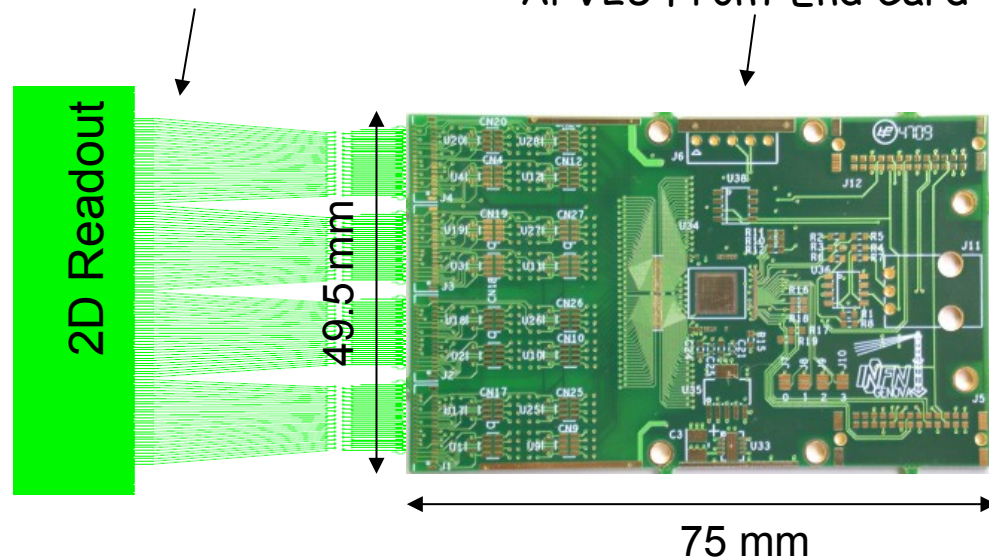
GEM chamber test setup at UVa

- APV25 based readout system with 2800 channels for testing prototype GEM chambers.
- Developed by INFN, manufactured by a commercial company

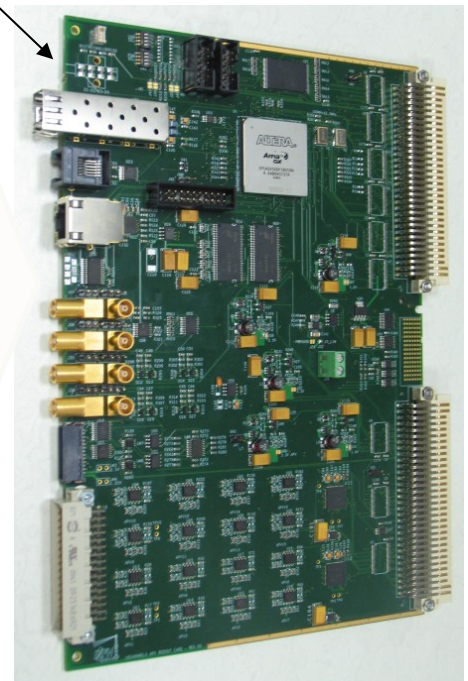
The GEM readout board

APV25 Front End Card

ADC + APV controller, housed in VME64x



Up to 10m
twisted,
shielded
copper
cable



Courtesy of Paolo Musico, INFN

- Iseg-Wiener MPOD High Voltage system with 16 sensitive HV channels to power GEM chamber
- System expandable to 160 channels.
- CODA (CEBAF Online Data Acquisition) based DAQ system
- A test setup complete with E/M calorimeter trigger is assembled for beam tests at Jlab